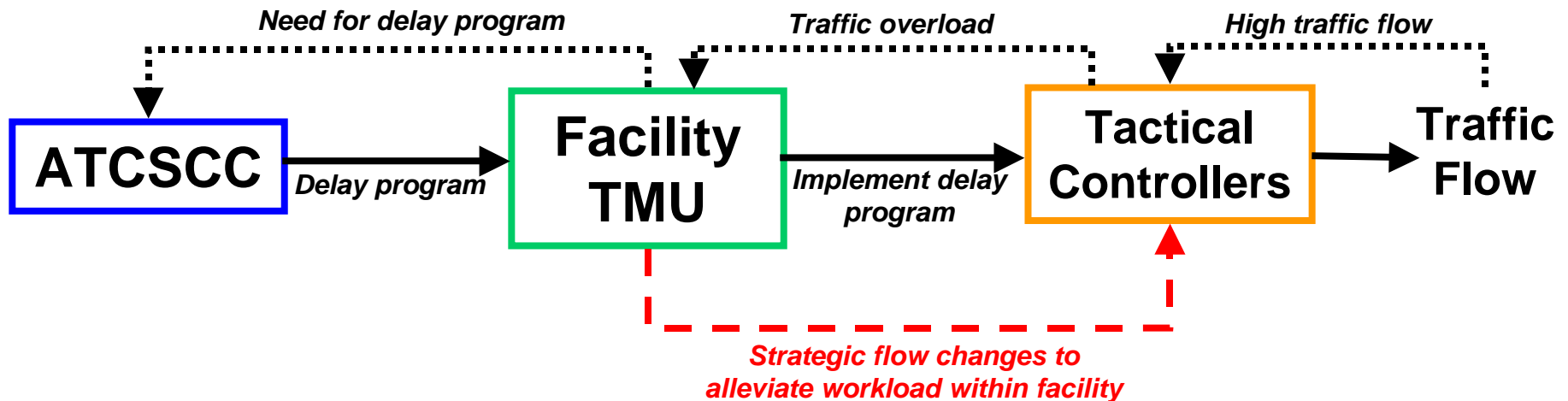![MIT ICAT logo]

Information Requirements for Inter-Facility ATC Coordination

Hayley J. Davison & R. John Hansman
Massachusetts Institute of Technology
International Center for Air Transportation

Motivation

- **As the air traffic increases, we must strengthen the communication between facilities (e.g., TMUs) so that the system will be more flexible to handle disturbances**
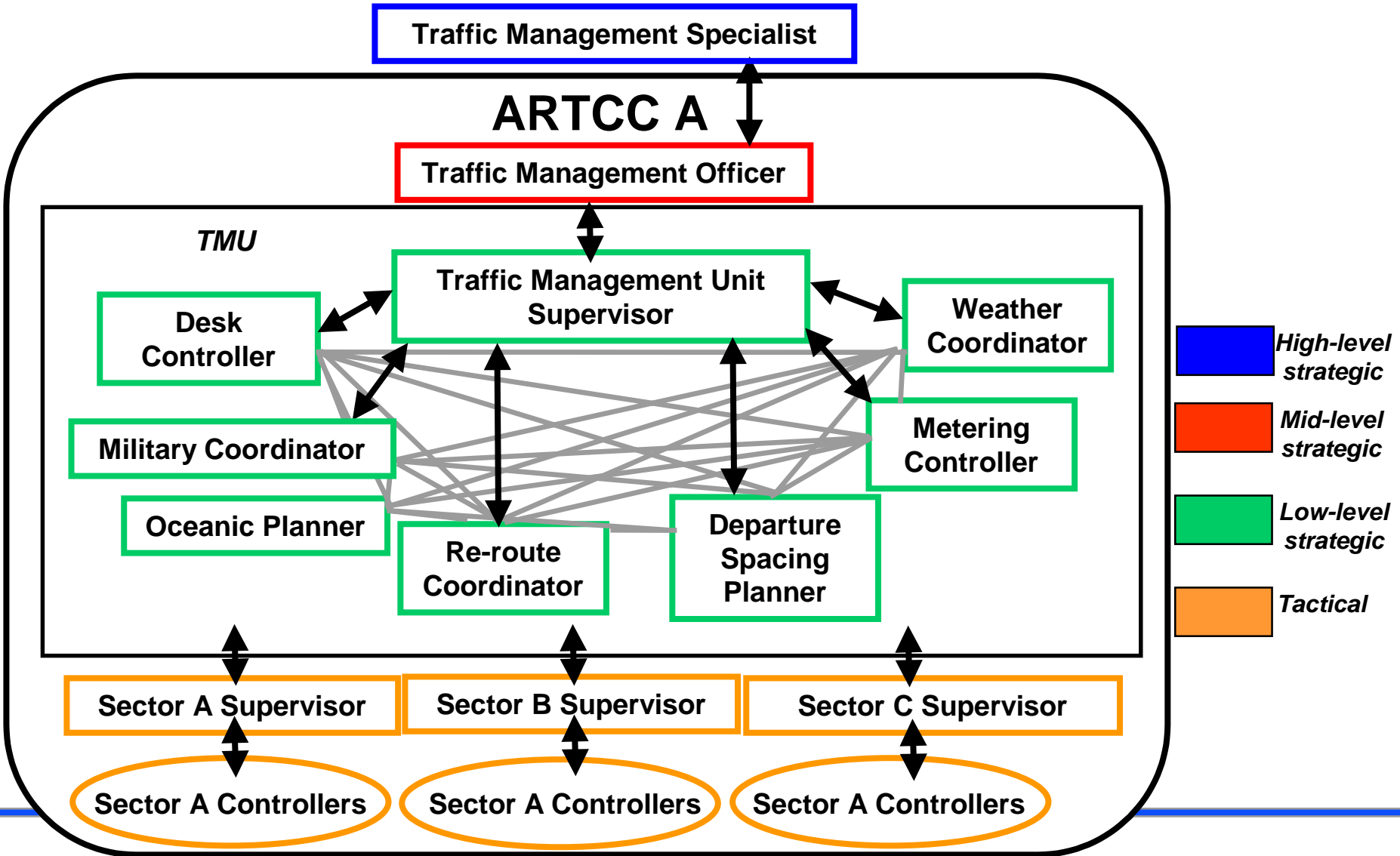
Need for delay program   *Traffic overload*   *High traffic flow*

```
ATCSCC  --Delay program-->  Facility TMU  --Implement delay program-->  Tactical Controllers  -->  Traffic Flow
```

Strategic flow changes to alleviate workload within facility

- **Coordination is improving (CDM, TMA, CRDA), but not on every level**

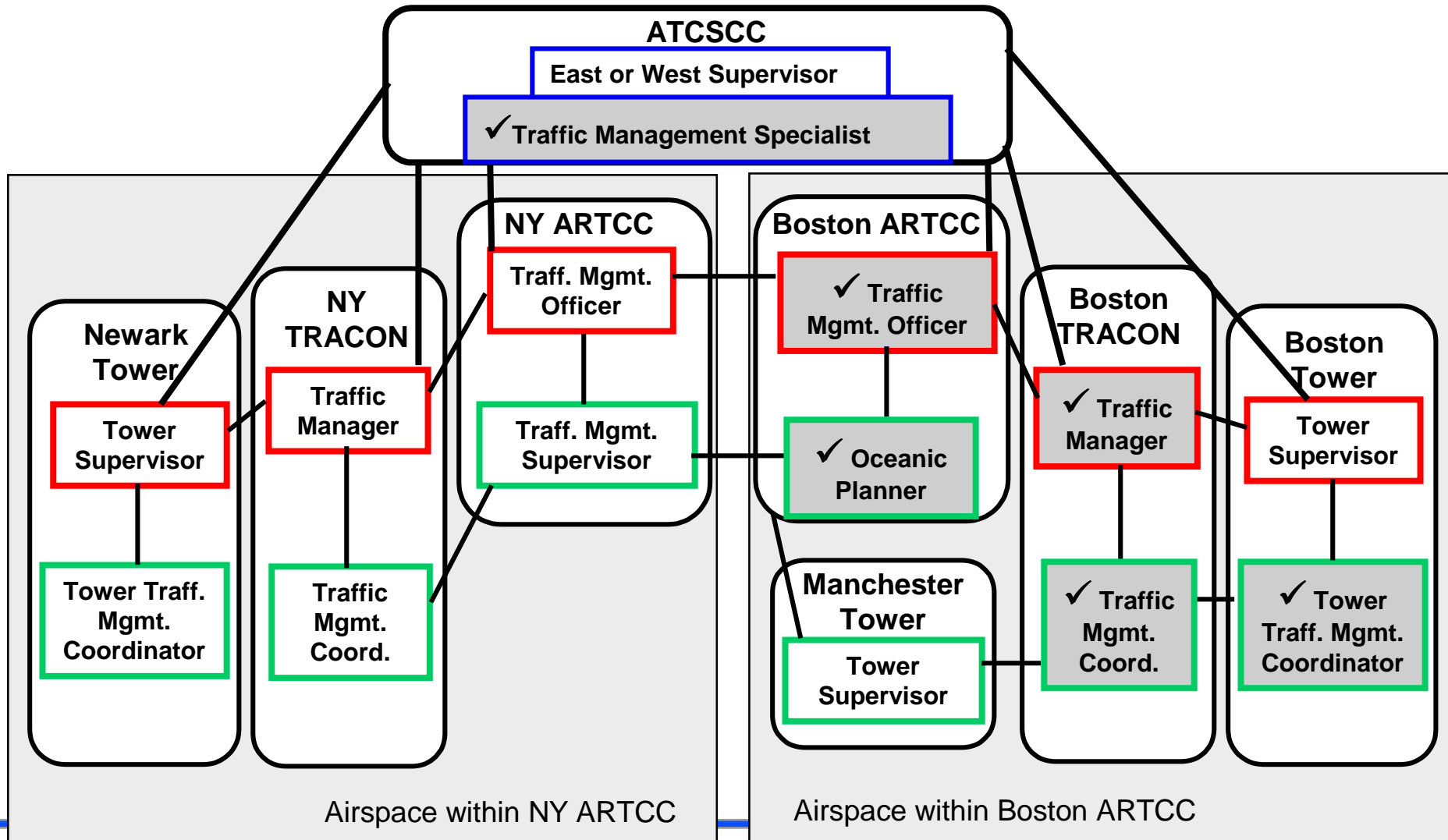- **There appears to be opportunities to improve information sharing at the inter-facility level**

Approach

- **Identify current communication/coordination structure based on single and multi-terminal environment examples (Boston & New York)**

  ❏ Perform interviews with strategic traffic flow managers, supervisors, and coordinators to investigate who, when and why they coordinate with others and how this coordination/communication can be improved

- **Determine controllers' coordination and information needs & how it relates to bottlenecks in the ATC system**

- **Determine functional requirements for an integrated coordination system**

Facility Level Communication Structure- Example: ARTCC

MIT ICAT

Traffic Management Specialist

ARTCC A

Traffic Management Officer

TMU

Traffic Management Unit Supervisor

Desk Controller

Weather Coordinator

Military Coordinator

Metering Controller

Oceanic Planner

Re-route Coordinator

Departure Spacing Planner

Sector A Supervisor

Sector B Supervisor

Sector C Supervisor

Sector A Controllers

Sector A Controllers

Sector A Controllers

High-level strategic

Mid-level strategic

Low-level strategic

Tactical

Interviews with Low to High Level Strategic Controllers

ATCSCC

East or West Supervisor

✓**Traffic Management Specialist**

NY ARTCC
- Traff. Mgmt. Officer
- Traff. Mgmt. Supervisor

Boston ARTCC
- ✓ Traffic Mgmt. Officer
- ✓ Oceanic Planner

Newark Tower
- Tower Supervisor
- Tower Traff. Mgmt. Coordinator

NY TRACON
- Traffic Manager
- Traffic Mgmt. Coord.

Boston TRACON
- ✓ Traffic Manager
- ✓ Traffic Mgmt. Coord.

Boston Tower
- Tower Supervisor
- ✓ Tower Traff. Mgmt. Coordinator

Manchester Tower
- Tower Supervisor

Airspace within NY ARTCC

Airspace within Boston ARTCC

✓ **Interviews completed**

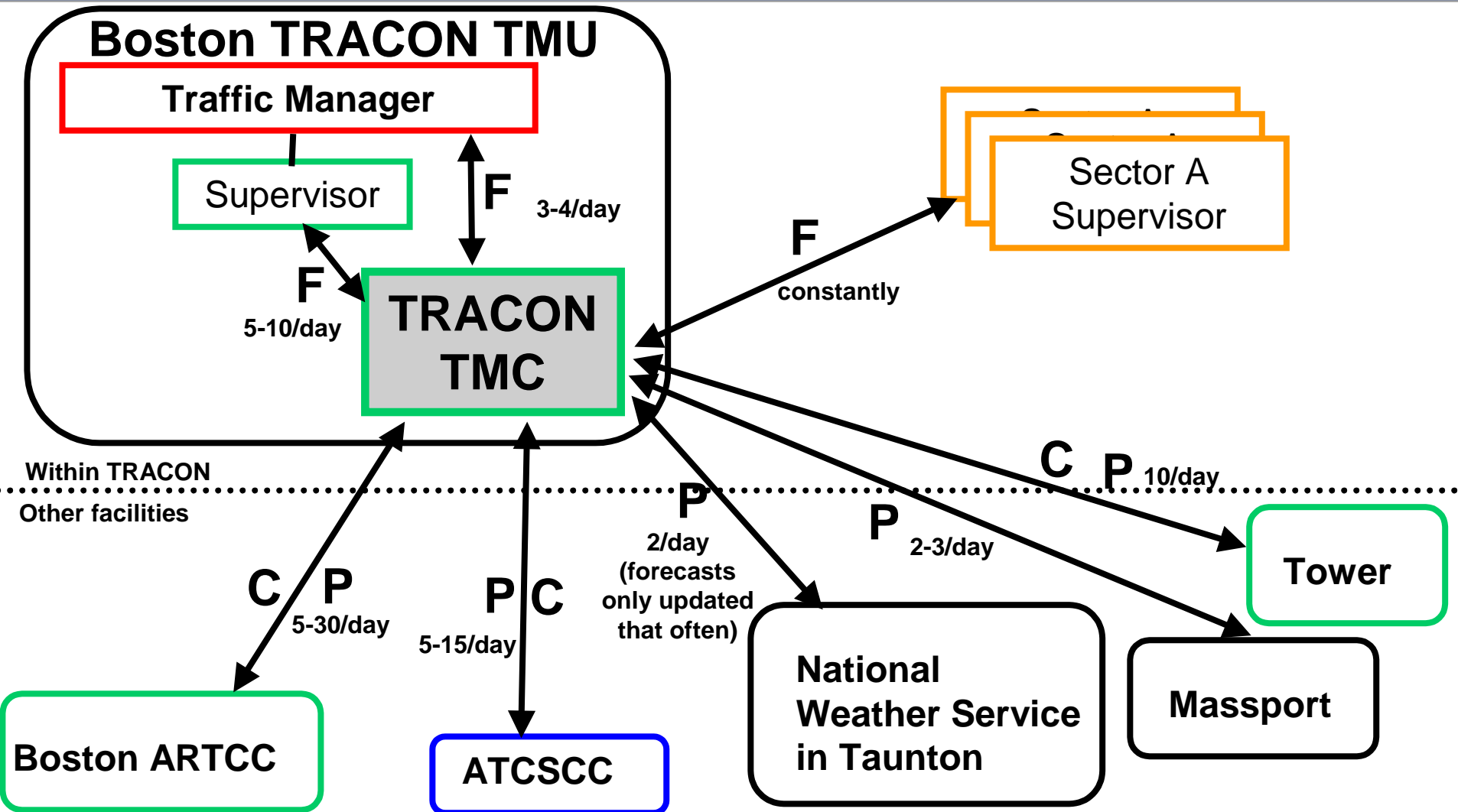# Preliminary Results- Case Studies

- **Boston TRACON Traffic Management Coordinator**

- **Boston ARTCC Traffic Management Officer**

- **ATCSCC Traffic Management Specialist**

- **Boston ARTCC Oceanic Planner**
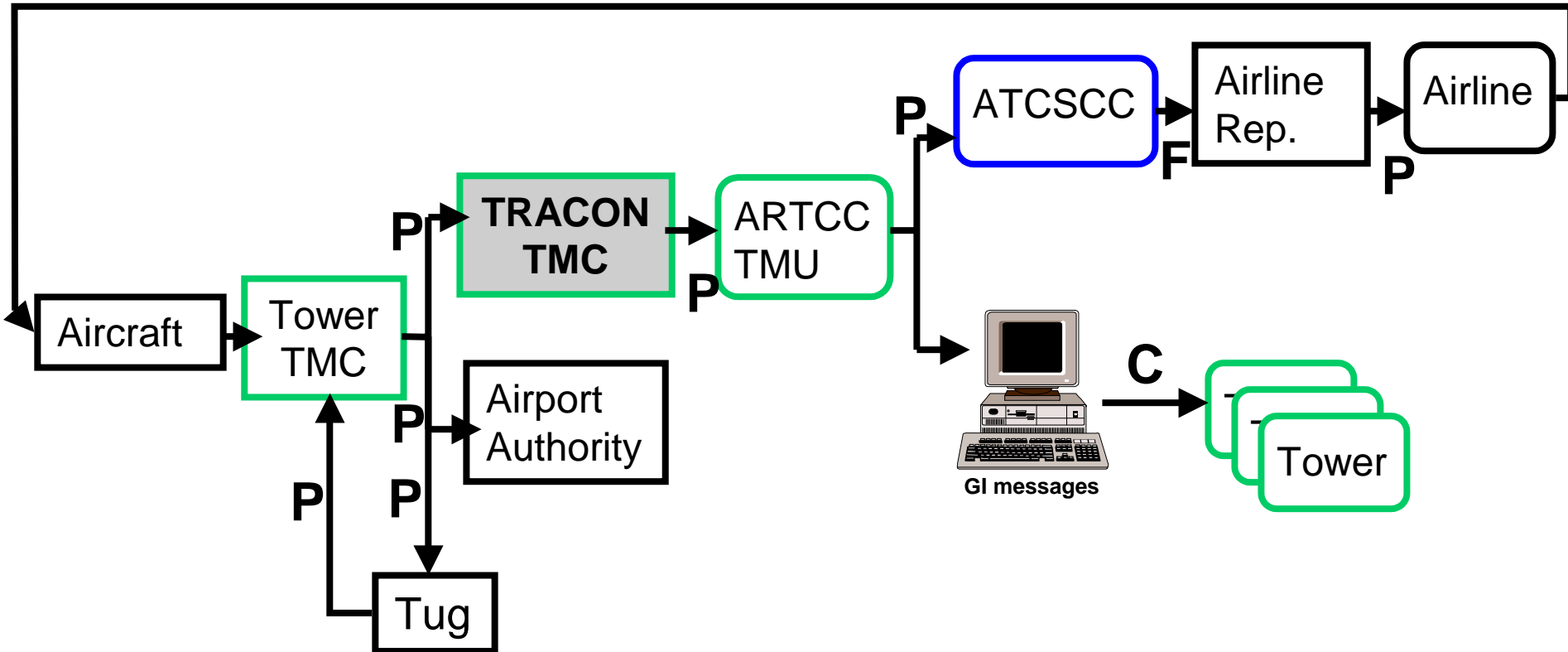
Example 1: Boston TRACON TMC

Coordination Structure-
TRACON TMC Example

MIT ICAT

Boston TRACON TMU

Traffic Manager

Supervisor

F 3-4/day

F 5-10/day

TRACON TMC

F constantly

Sector A Supervisor

Within TRACON

Other facilities

C P 10/day

C P 5-30/day

P C 5-15/day

P 2/day (forecasts only updated that often)

P 2-3/day

Tower

Boston ARTCC

ATCSCC

National Weather Service in Taunton

Massport

C: Computer communication   **P:** Phone Communication   **F:** Face to Face Communication

C

P ATCSCC → Airline Rep. → Airline

F

P

P TRACON TMC → ARTCC TMU

P

Aircraft → Tower TMC

P → Airport Authority

P **P**

P Tug

GI messages

C → Tower

Information (e.g., which runway is closed, how long the tower expects it to be closed) is passed through the strategic ranks of the ATC system both through face-to-face, phone and computer modalities
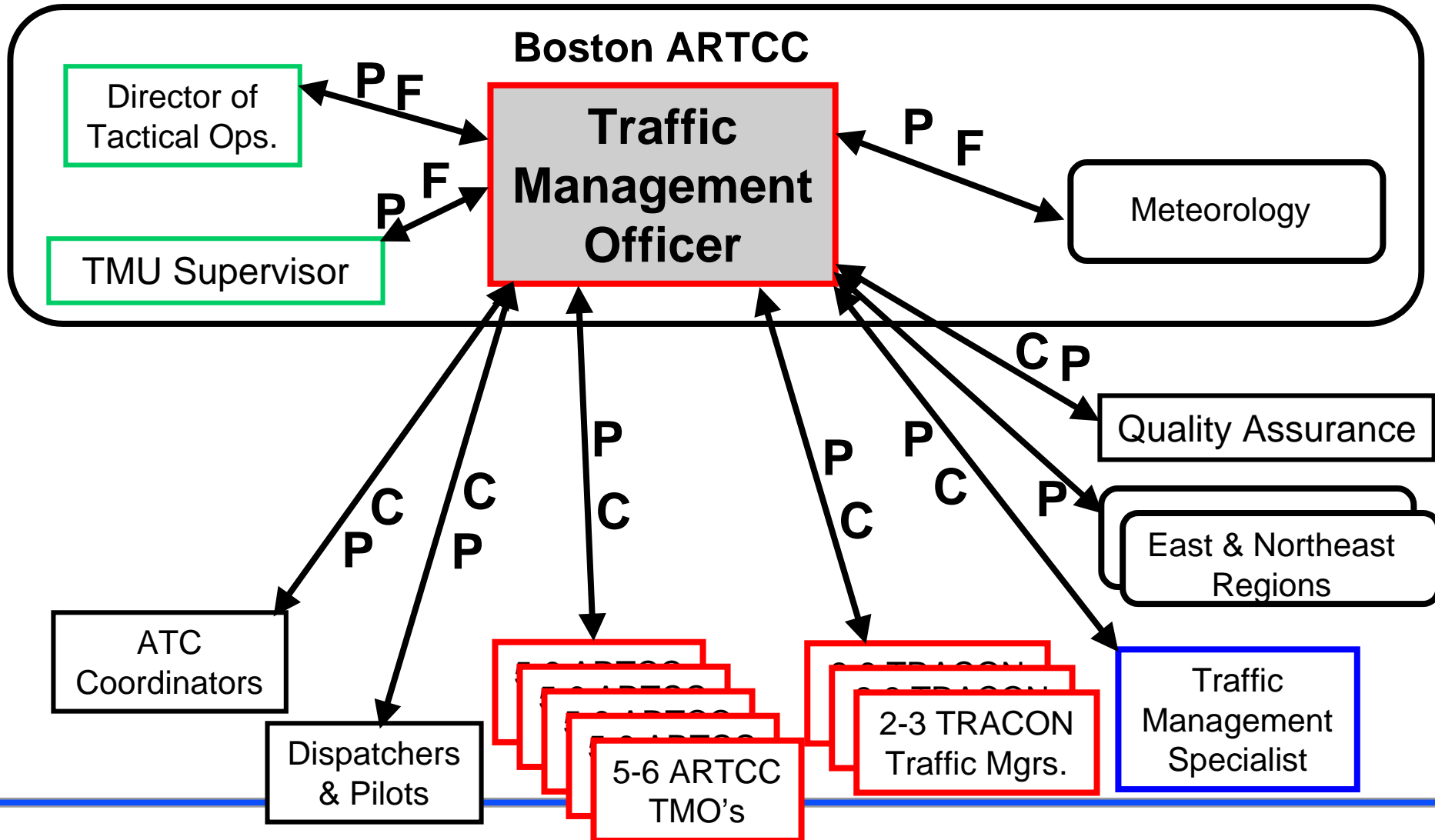
TRACON TMC

- **Information quality is important to the TRACON TMC**
  - ❏ Weather forecasts (integrated from NWS, Center meteorologists and possibly Massport contractor if the first two contradict each other)
  - ❏ Demand forecasts (found fairly accurately from the TSD)
  - ❏ Individual work styles of area controllers

- **Ability to negotiate with TMCs from other facilities is critical**
  - ❏ Knowledge of structure and capacity of other facility
  - ❏ Knowledge of needs and wants of other facilities
  - ❏ Personal acquaintance with TMC makes it more likely to negotiate smoothly

- **This position is highly dependent on the individual TRACON TMC's ability to approach the limits of capacity without sacrificing safety**

- **Communication/Coordination Improvements**
  - ❏ Integrate information-sharing tools: FDIO/GI Messages, TSD, Information Display System (IDS)
  - ❏ Increase pro-active traffic flow management by educating TMCs about the structure and procedures in adjacent facilities

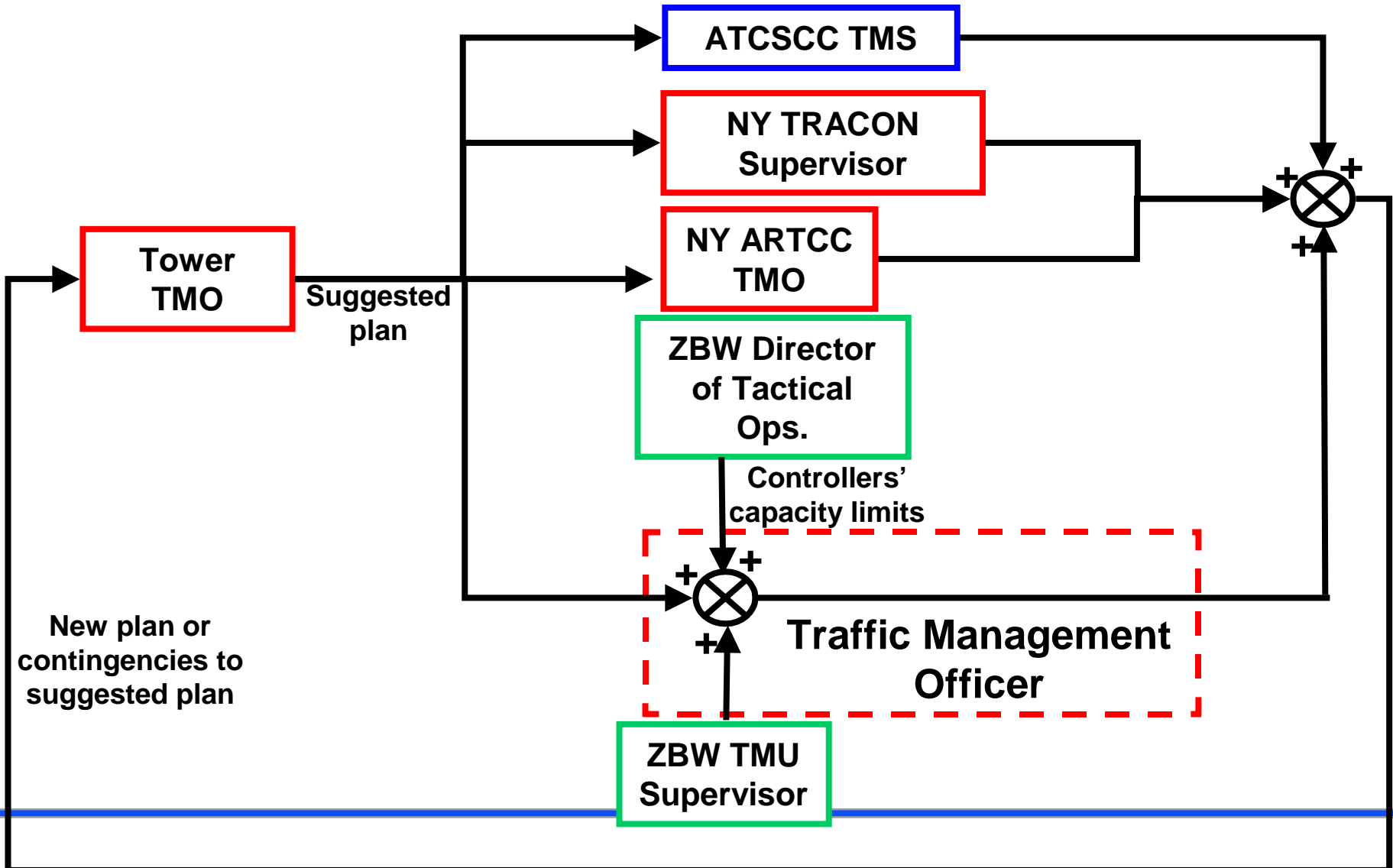# Example 2: Boston ARTCC Traffic Management Officer

Coordination structure- ZBW Traffic Management Officer

MIT ICAT

Boston ARTCC

Traffic Management Officer

Director of Tactical Ops. — **P F** ←→

TMU Supervisor — **P F** ←→

Meteorology — **P F** ←→

Quality Assurance — **C P**

East & Northeast Regions — **P C**

ATC Coordinators — **P C**

Dispatchers & Pilots — **C P**

5-6 ARTCC TMO's — **P C**

2-3 TRACON Traffic Mgrs. — **P C**

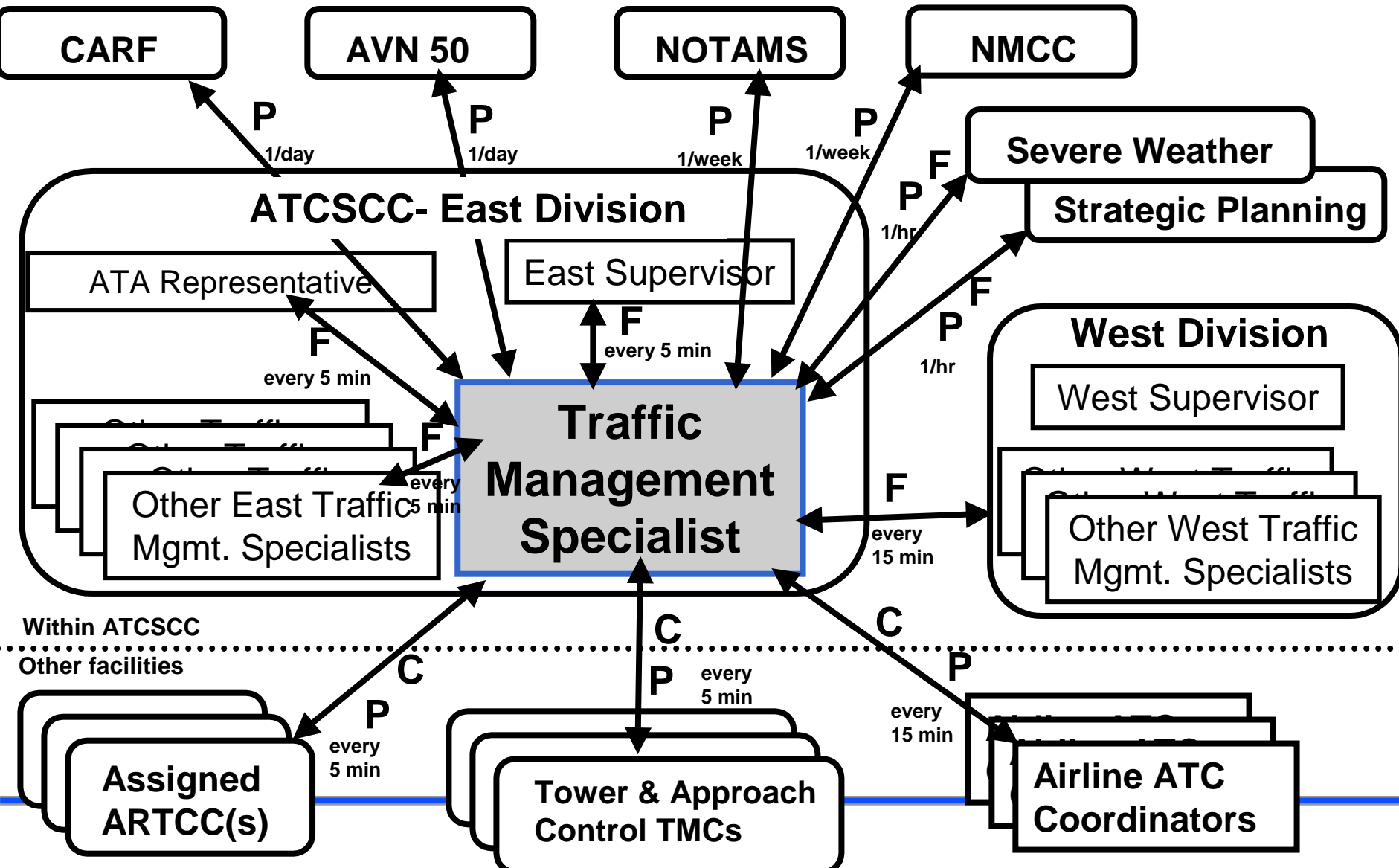Traffic Management Specialist — **P C**

ZBW Traffic Management Officer

- **The Traffic Management Officer position depends greatly on negotiating with other facilities to remedy traffic situations both dynamically and strategically.**

- **Decisions made are based on shared information**
  - ❏ Demand estimates
  - ❏ Controller capacity limits
  - ❏ Weather
  - ❏ Staffing

- **TMO finds that the ability to communicate directly with individuals is critical to the ability to negotiate solutions**

- **Communication/Coordination improvements**
  - ❏ Increase the availability of shared information (updated demand estimates, weather forecasts)

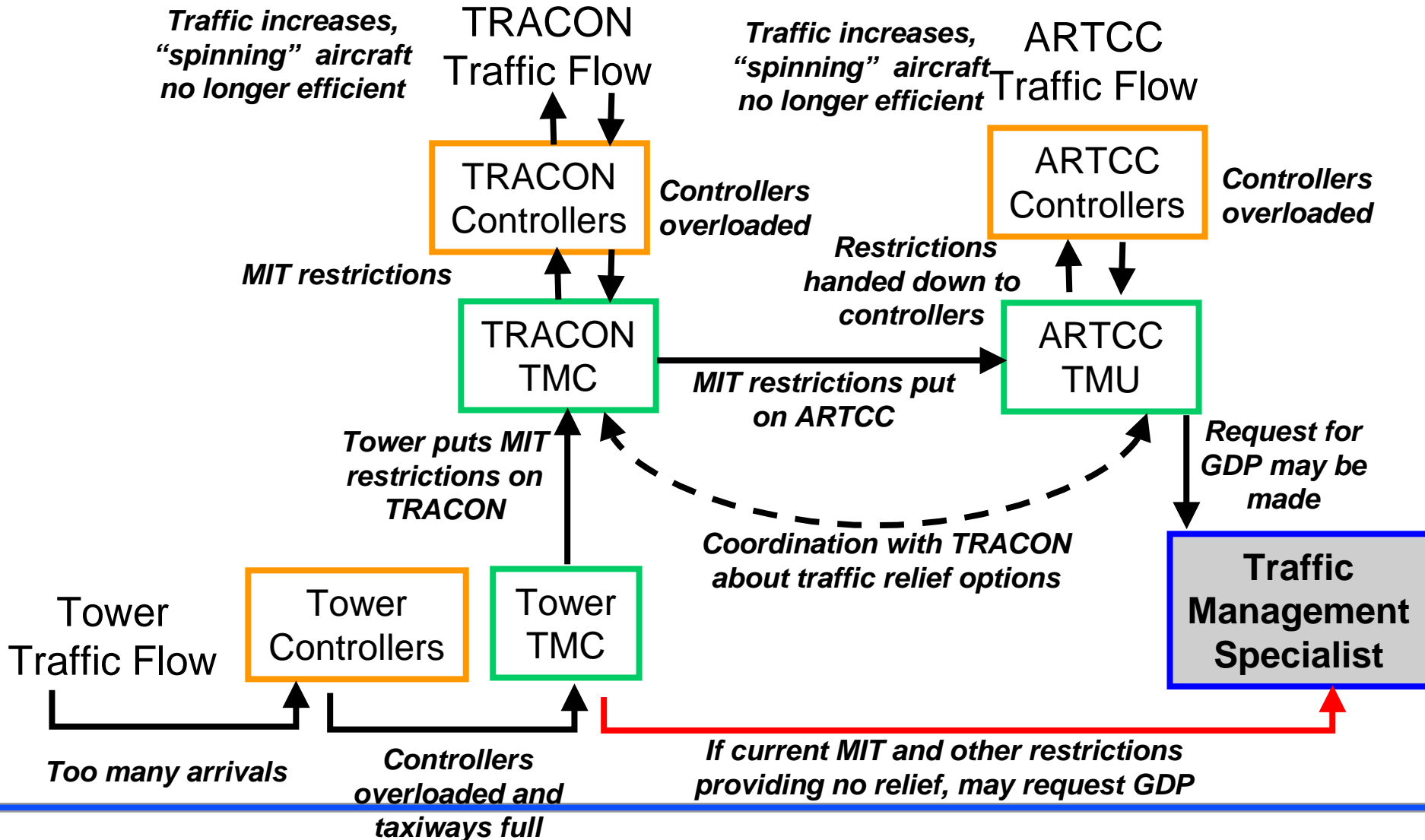# Example 3: ATCSCC Traffic Management Specialist

Communication Structure-
ATCSCC Traffic Management Specialist

MIT ICAT

CARF	AVN 50	NOTAMS	NMCC

P 1/day

P 1/day

P 1/week

P 1/week

ATCSCC- East Division

Severe Weather

P **F**

Strategic Planning

P 1/hr

ATA Representative

East Supervisor

F every 5 min

F every 5 min

F

P 1/hr

West Division

West Supervisor

Other East Traffic Mgmt. Specialists

F every 5 min

Traffic Management Specialist

F every 15 min

Other West Traffic Mgmt. Specialists

Within ATCSCC

Other facilities

C

C

Assigned ARTCC(s)

C

P every 5 min

P every 5 min

Tower & Approach Control TMCs

P every 15 min

Airline ATC Coordinators

Information Flow- GDP Implementation Example

MIT ICAT

Traffic increases, "spinning" aircraft no longer efficient

TRACON Traffic Flow

Traffic increases, "spinning" aircraft no longer efficient

ARTCC Traffic Flow

TRACON Controllers

Controllers overloaded

ARTCC Controllers

Controllers overloaded

MIT restrictions

Restrictions handed down to controllers

TRACON TMC

MIT restrictions put on ARTCC

ARTCC TMU

Tower puts MIT restrictions on TRACON

Request for GDP may be made

Coordination with TRACON about traffic relief options

Tower Traffic Flow

Tower Controllers

Tower TMC

Traffic Management Specialist

Too many arrivals

Controllers overloaded and taxiways full

If current MIT and other restrictions providing no relief, may request GDP

Information Flow- GDP Implementation Example

MIT ICAT

Airline Reps.

Other Traffic Management Specialists

Supervisor

TSD

+ **+** **+**

Demand expected for airport

Airports Towers ARTCCs

Airlines

TMS experience

+ **+** **+**

Determine need for GDP

Evaluate alternatives

Traffic Management Specialist

FDIO/GI messages

Request for GDP

Tower TMC

+ **+**

ARTCC TMC

P

P

- **Traffic Management Specialists rely on the low level strategic controllers to suggest implementation of system-level flow management initiatives**

  - ❏ Need recommendation and/or experience to implement initiative
  - ❏ Need accurate demand measures from TSD and other TMS's

- **This position is highly dependent on coordination and communication**

  - ❏ Low level strategic controllers (ARTCC TMU & Tower TMC)
    - ● When initiative is needed
    - ● When initiative should be stopped
    - ● What alternatives are present
  - ❏ Communicate with other TMS's to determine effect on the system

- **Communication/Coordination improvements**

  - ❏ TMS's should be very familiar with the capacity and procedures of the facilities that they control
  - ❏ Currently the TMS is reactive to the problems that the facility may have, should become more proactive in determining when the facility will become saturated

Example 4: Boston ARTCC Oceanic Planner

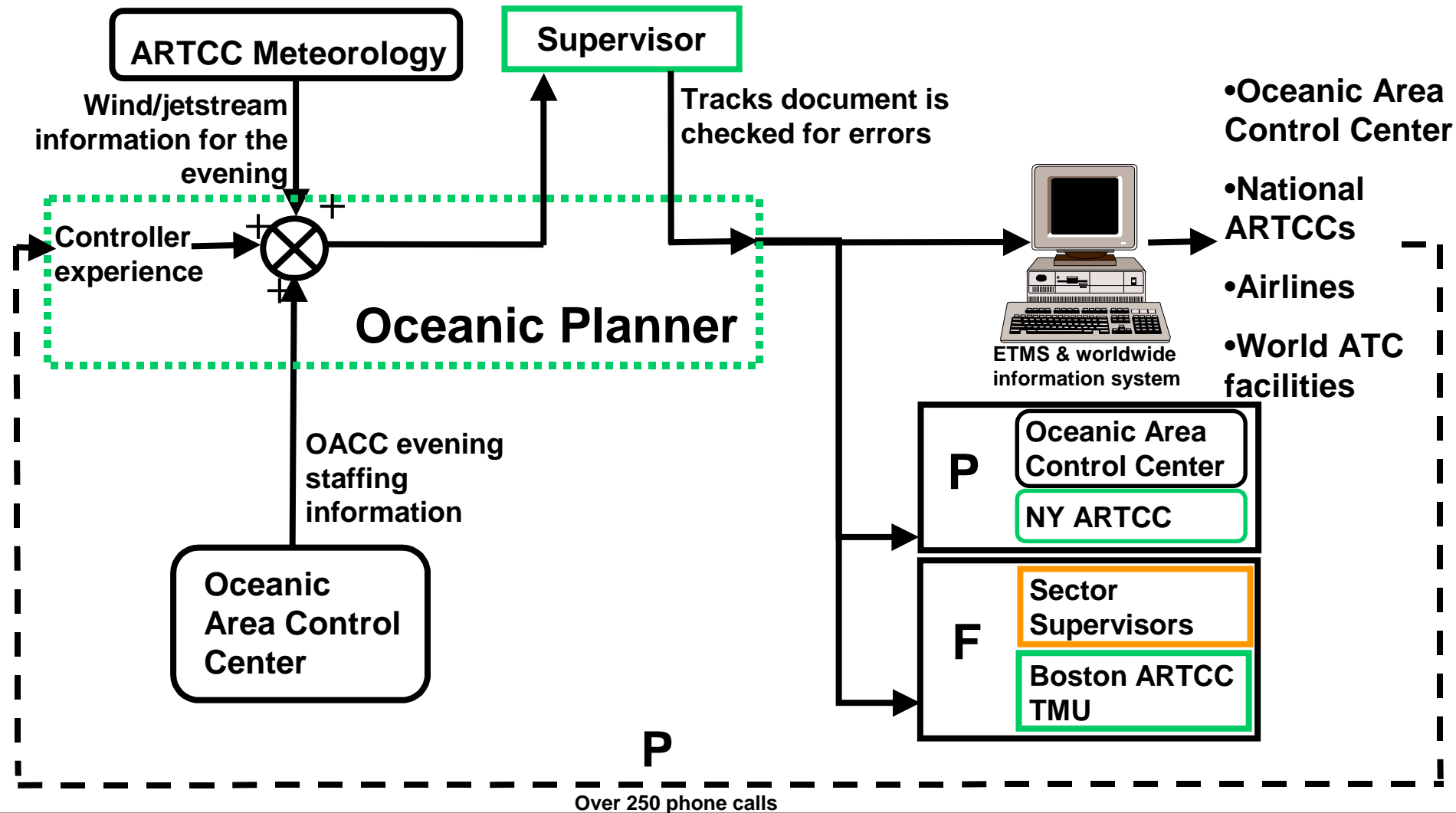# Coordination Structure- ZBW Oceanic Planner example

MIT ICAT

Boston ARTCC TMU

Traffic Mgmt. Officer

Supervisor

Departure Spacing Controllers

Weather Coordinator

Military Coordinator

Metering Controller

Oceanic Planner

Meteorology

Sector A Supervisor

F

F

F

F

F

F

F

F

Within ARTCC

Other facilities

P

P

C

C

New York ARTCC

Oceanic Area Control Center
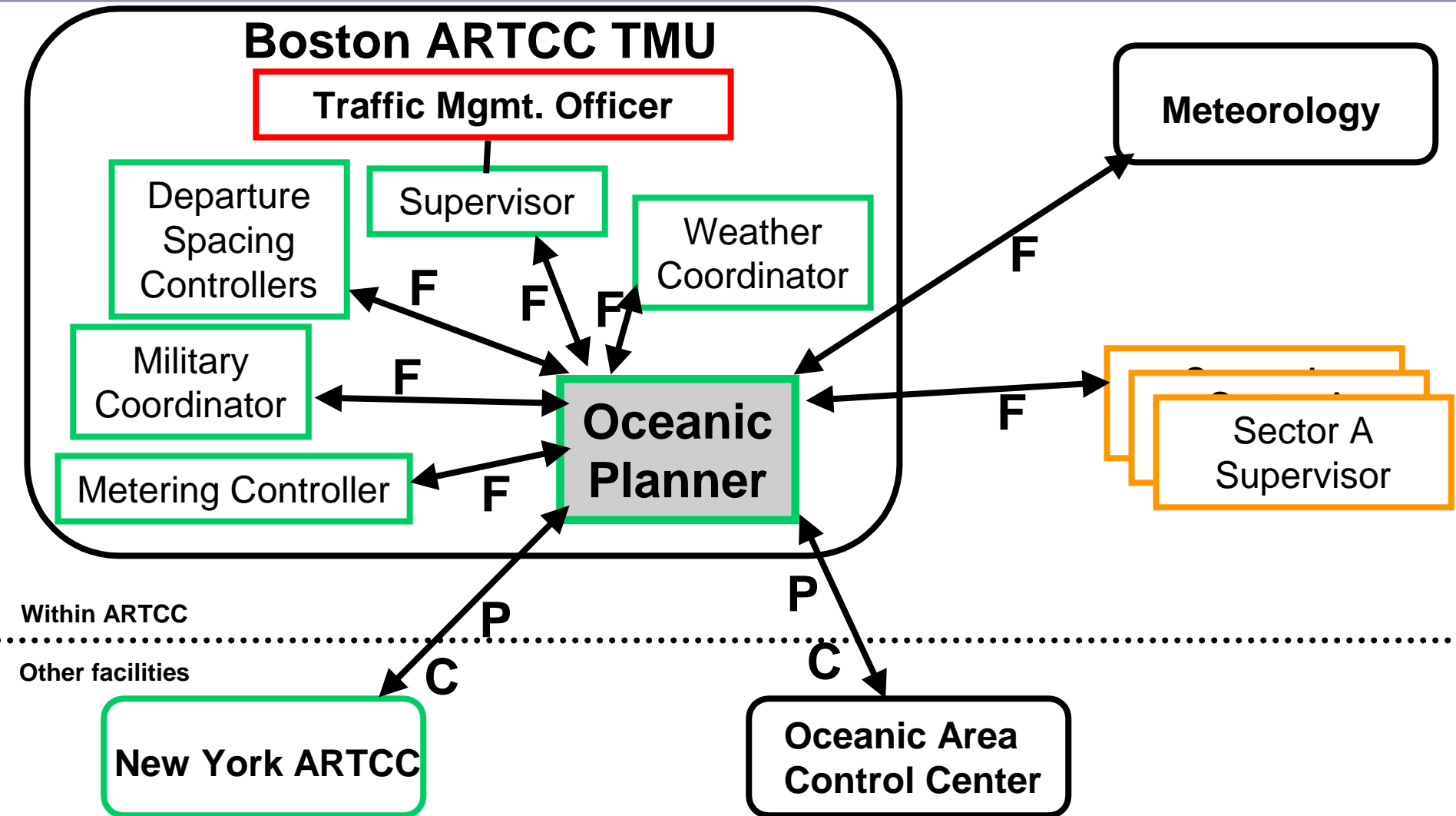
C: Computer communication   **P:** Phone Communication   **F:** Face to Face Communication

Information flow- Oceanic Tracks example

ARTCC Meteorology

Supervisor

Wind/jetstream information for the evening

Tracks document is checked for errors

•**Oceanic Area Control Center**

•**National ARTCCs**

Controller experience

Oceanic Planner

ETMS & worldwide information system

•**Airlines**

•**World ATC facilities**

OACC evening staffing information

Oceanic Area Control Center

P **Oceanic Area Control Center**

NY ARTCC

F **Sector Supervisors**

Boston ARTCC TMU

P

Over 250 phone calls

ZBW Oceanic Planner

- **Oceanic Planner is a secondary duty of a TMC's regular appointment (e.g., military coordinator, desk controller)**

- **Requires high-quality information to be supplied**
  - ❏ Accurate wind & jetstream forecasts
  - ❏ OACC staffing information

- **Little coordination needed to perform tasks**
  - ❏ Uses information gathered from other facilities to determine appropriate routings to oceanic tracks twice per day
  - ❏ Asks member of TMU to double-check the tracks once they are printed out
  - ❏ Feedback from users (airlines) and other facilities only if tracks are not supplied by a certain time

- **This position is not a coordination-critical position**

- **Communication/Coordination improvements**
  - ❏ Ensure high quality information is passed to the Oceanic Planner
  - ❏ Provide some early form of feedback to the Oceanic Planner so that the TMU is not bombarded by phone calls if the Oceanic Tracks are late

Issues Emerging Due to System Structure

- **Areas of Protection**
  - ❏ Each area (e.g., sector, facility, region) operates to its maximum risk threshold to maximize the efficiency without sacrificing safety
  - ❏ Different risk thresholds for different facilities- (Providence Tower v. Boston Tower, Cleveland ARTCC v. NY ARTCC)

- **Lack of "system" concern**
  - ❏ As long as the area is functioning at capacity, the controllers are not concerned with other areas

- **Personal Negotiations**
  - ❏ Personal communication & negotiation is used to battle the "Lack of system concern" mentality
  - ❏ Visiting other facilities on a regular basis helps
    - ▪ Develop personal acquaintances at other facilities
      - o Easier to negotiate with an acquaintance or friend
      - o Understand state of other person better (able to distinguish a critical situation from a non-critical situation, able to predict the saturation point of other individual)
    - ▪ Bigger picture of system impact
      - o Can see what effect implementing a delay initiative has on other facilities
      - o Can take a proactive position during a negotiation with other facility

- **Opportunity to enhance communications structure through:**
  - ❏ Integrated information sharing tools
  - ❏ Encouraging pro-active traffic management
  - ❏ Investigating further the significance of personal communications among individuals

Future Directions

- **Continue interviews with ARTCC's, TRACONs, Towers, and ATCSCC**

- **Consolidate results into a set of case studies describing current communication/coordination structure at different levels of ATC**

- **Identify improvements in coordination/communication that need to be made using specific examples from case studies**

- **Provide a set of functional requirements and potential benefits for future integrated communication/coordination tool(s)**